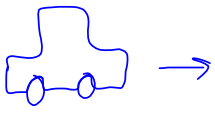
A car accelerates from 13 m/s to 42 m/s at a rate of 12 m/s/s. How long did it take the car to reach the final velocity?



$a = +12\ m/s^2$

$t = ?$

$v_i = 13\ m/s \qquad v_f = 42\ m/s$

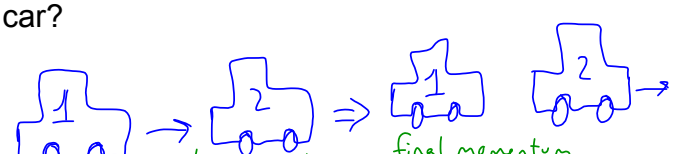
$$a = \frac{v_f - v_i}{t}$$

$$t = \frac{v_f - v_i}{a}$$

$$= \frac{42\ m/s - 13\ m/s}{12\ m/s^2}$$

$$= 2.42\ s$$

A car with a mass of 4200 kg and a velocity of 35 m/s slams into a stationary car of mass 2200 kg. If the first car comes to a complete stop after the collision, what is the velocity of the second car?



$$\bar{p}_{1i} + \bar{p}_{2i} = \bar{p}_{1f} + \bar{p}_{2f}$$

$$\bar{p}_{1i} = \bar{p}_{2f} \qquad \bar{p} = m\bar{v}$$

$$m_1 \bar{v}_{1i} = m_2 \bar{v}_{2f}$$

$$v_{2f} = \frac{m_1 v_{1i}}{m_2}$$

$$= \frac{(4200\ kg)(35\ m/s)}{2200\ kg}$$

$$= 66.82\ m/s$$

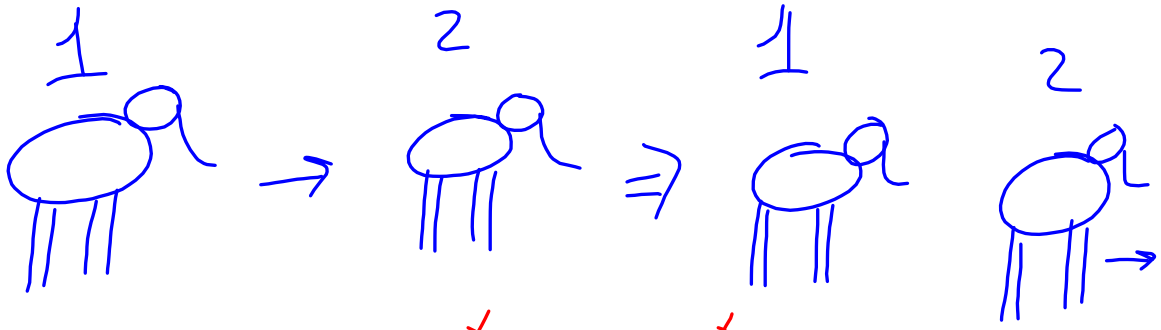
If collision happens in 0.25 s, what is acceleration of the 2nd car?

$$a = \frac{v_f - v_i}{t} = \frac{66.82\ m/s - 0\ m/s}{0.25\ s}$$

$$= 267.28\ m/s^2$$

variable	unit
displacement	m
distance	m
time	s
velocity	m/s
speed	m/s
acceleration	m/s^2 (m/s/s)
momentum	kg · m/s

A 3500 kg elephant with a velocity of 4 m/s collides with a stationary elephant. The second elephant begins to move at 2.75 m/s. What is the mass of the second elephant?



$$m_1 v_{1i} + m_2 v_{2i} = m_1 v_{1f} + m_2 v_{2f}$$

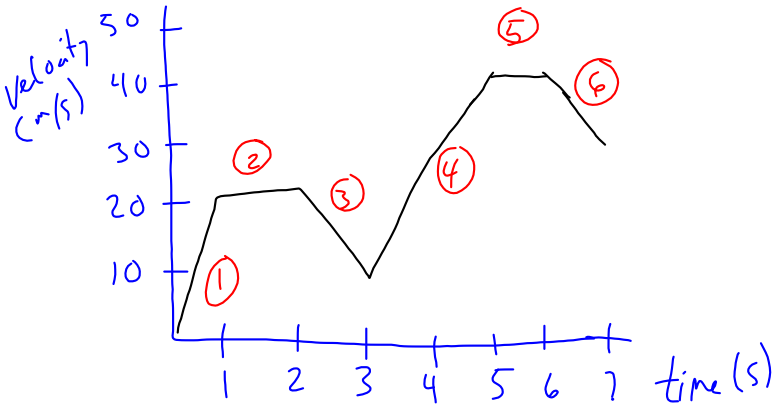
$$m_1 v_{1i} = m_2 v_{2f}$$

$$m_2 = \frac{m_1 v_{1i}}{v_{2f}}$$

$$= \frac{(3500\ kg)(4\ m/s)}{2.75\ m/s}$$

$$= 5090.91\ kg$$

Velocity – Time Graphs



$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{\text{velocity}}{\text{time}} = \text{acceleration}$$

$$= \frac{y_2 - y_1}{x_2 - x_1} = \frac{v_2 - v_1}{t_2 - t_1}$$

positive slope → velocity is increasing, so the acceleration is positive

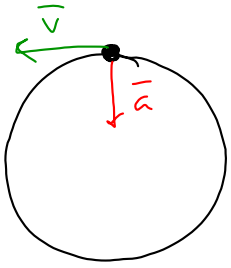
1, 4 on graph above

negative slope → velocity is decreasing so the acceleration is negative

3, 6 on graph above

∅ slope → constant velocity, so acceleration is ∅

2, 5 on graph above



Line of Best Fit

- Estimate of data we have
- Goes through points equally spaced above and below
- Get an equation in $y = mx + b$